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ABSTRACT

During the 1978-1979 academic year, seventh- and eighth-grade students at 13 junior high schools in Southern Illinois participated in a study which provided data on mathematics achievement, student career interests, and parent attitudes toward their children as learners of mathematics. During the 1982-1983 academic year, these students (N=415; 196 females and 219 males) participated as twelfth-graders in a follow-up study. Data were collected on their attitudes toward mathematics, career interests, selection of a computer course during high school, highest level of mathematics course successfully completed or completing, and their academic plans. This report contains the results of the follow-up study. Specific areas addressed include: frequency distribution by sex and by eighth-grade mathematics achievement scores of student continuation in the mathematics study sequence; continuance in the mathematics study sequence as related to attitudes toward mathematics and student career interests; to what extent cognitive and affective mathematics-related variables measured at grade 8 serve as predictors of continuation in the mathematics study sequence; the effect of parent attitudes toward mathematics on continuation in the mathematics study sequence; changes in attitudes toward mathematics from grade 8 to grade 12; career interests in grade 8; and relationships between mathematics-related variables and computer course participation. Based on the results of this research, it is recommended that efforts to increase student continuation in the mathematics study sequence should include the participation of teachers, administrators, counselors, parents and students since parents, teachers, and counselors play an important role in shaping student attitudes toward mathematics. An extensive bibliography concludes the document. (JN)

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Affective and Cognitive Mathematics Related Variables: A Longitudinal Study

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Affective and Cognitive
Mathematics-Related Variables:
A Longitudinal Study

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Affective and Cognitive
Mathematics - Related Variables:
A Longitudinal Study

During the 1978-1979 academic year, the seventh and eighth grade students at 13 junior high school in Southern Illinois participated in a study of attitudes toward mathematics. During the 1982-1983 academic year, the students who participated as eighth graders in the junior-high study, participated as twelfth graders in a follow-up study. This report contains the results of the follow-up study and has been prepared in order to communicate the results to the participating high schools. Copies of research papers resulting from the initial and the follow-up studies are available from the authors.

We would like to take this opportunity to list the participating schools and to thank the administrators and teachers at each school for their cooperation. We are confident that such cooperation between classroom teachers, administrators, and researchers will help provide better education at all levels.

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Affective and Cognitive
Mathematics - Related Variables:
A Longitudinal Study

Recent pronouncements at the local, state, and national level have focused attention on mathematics education at both the elementary and secondary level. A concern, voiced by educators, is that students are not electing to take mathematics courses during high school sufficient to prepare them for immediate employment or for further study. This concern is further aggravated by evidence that disproportionately fewer females than males continue in the mathematics study sequence in high school.

Because the junior high years represent the end of a common mathematics curriculum, researchers have looked to those years for an understanding of variables which appear to affect later mathematics participation and achievement.

The primary purpose of the study being reported here was to investigate the relationships between cognitive and affective mathematics related variables and continuation in the mathematics study sequence. There are presented, also, the results of the study of the relationships between mathematics-related variables and computer course participation. Specific questions discussed in this report are

Q1. What is the frequency distribution by sex and by eighth grade mathematics achievement scores of student continuation in the mathematics study sequence?

Q2. What is the relationship between attitudes toward mathematics, measured at grade eight and at grade twelve, and continuation in the mathematics study sequence?

Q3. What is the relationship between student career interests, measured at grade eight and at grade twelve, and continuation in the mathematics study sequence?

Q4. To what extent can the cognitive and affective mathematics related variables measured at grade eight serve as predictors of continuation in the mathematics study sequence.

Q5. What is the effect of parent attitudes toward mathematics on continuation in the mathematics study sequence?

Other questions discussed are

Q6. What are the changes in attitudes toward mathematics from grade eight to grade twelve?

Q7. What career interests are displayed at grade eight?

A final section (Q8) of this report summarizes the results related to student election of a computer course in high school.

DESCRIPTION OF THE STUDY

The subjects were 415 students, 196 females and 219 males, who participated in the study as eighth graders and again as twelfth graders. During the eighth grade, data were collected on mathematics achievement, student attitudes toward mathematics, student career interests, and parent attitudes toward their children as learners of mathematics. During the twelfth grade, data were collected on student attitudes toward mathematics, student career interests, student selection of a computer course during high school, highest level of mathematics course successfully completed or completing that year, and student academic plans.

Mathematics achievement was measured by the national percentile rank attained by the student on one of the following standardized achievement tests: California Achievement Tests (Tiegs & Clark, 1970); Comprehensive Test of Basic Skills (California Test Bureau, 1973); Iowa Test of Basic Skills (Hieronymus, Lindquist, & Hoover, 1971); Science Research Associates Assessment Survey (Thorpe, Lafever, & Naslund, 1974); and Stanford Mathematics Tests (Madden, Gardner, Rudman, Karlsen, & Mervin, 1973). Students scoring above the sixtieth percentile on the mathematics achievements tests were defined to be high-achievers in mathematics; other students were defined to be average-achievers in mathematics. For certain statistical

tests, mathematics achievement scores were grouped by quarters of distribution (in descending order: upper, 3rd, 2nd, and lower).

Student attitudes toward mathematics were measured by the Fennema-Sherman Mathematics Attitude Scales (Fennema & Sherman, 1976). The subscales are Confidence in Learning Mathematics, Mother, Teacher, Usefulness of Mathematics, Effectance Motivation, Father, Attitude Toward Success in Mathematics, and Math as a Male Domain. A high subscale score indicates a positive attitude toward mathematics, and a low subscale score indicates a negative attitude toward mathematics. In the Math as a Male Domain scale, a high score indicates less stereotyping of mathematics as a male domain.

Student career interests were measured by the Unisex ACT Interest Inventory (UNIACT) (The American College Testing Program, 1977). The UNIACT is a sex-balanced interest inventory consisting of 90 items each with a three-response range: dislike, indifferent, like. The UNIACT assesses six career areas: Business Sales and Management, Business Operations, Technology and Trade, Natural, Social, and Medical Science, Creative and Applied Arts, and Social, Health, and Personal Services. (The 6 career areas will be referred to as Management, Business Operations, Technology, Science, Arts, and Services, respectively). UNIACT also assesses two underlying dimensions of work-related activity

preferences: a Data-Ideas dimension and a People-Things dimension. A higher score on the Data-Ideas subscale indicates more interest in data; a lower score on the Data-Ideas subscale indicates more interest in ideas. A higher score on the People-Things subscale indicates more interest in people; a lower score on the People-Things subscale indicates more interest in things.

The parent variables consisted of each parent's response to the Math as a Male Domain Scale and to each parent's response to an adaptation of the Mother Scale (for the mother or female guardian) or an adaptation of the Father Scale (for the father or male guardian). The adaptation of the Mother Scale (similarly, the Father Scale) consisted of rewriting the statement to reflect the mother's attitude toward her child as a learner of mathematics. For example, an item on the Mother Scale such as "My mother thinks I'm the kind of person who could do well in mathematics" was rewritten for the parent version to read "I think my child is the kind of person who could do well in mathematics."

During the twelfth grade, students were again administered the Fennema-Sherman Mathematics Attitudes Scales and the Unisex ACT Interest Inventory. Continuation in the mathematics study sequence was measured by students' self reporting of high school mathematics courses successfully completed or under completing that year. The

data were ordinally scaled to reflect the highest level of mathematics course successfully completed or under completion. The scale was 1 (pre-algebra); 2 (algebra I); 3 (geometry); 4 (algebra II); 5 (trigonometry and/or analytic geometry); and 6 (calculus). Students also responded to questions concerning elective high school computer courses successfully completed or under completion. A dichotomous variable (1, yes; 0, no) defined computer course participation.

Academic plans were measured by the answers to the following questions: Do you plan to further your education? (1, yes; 0, no). In what type of school do you plan to further your education? (1, community college; 2, university; 3, vocational training; 4, other).

The .01 level of significance was chosen for the study.

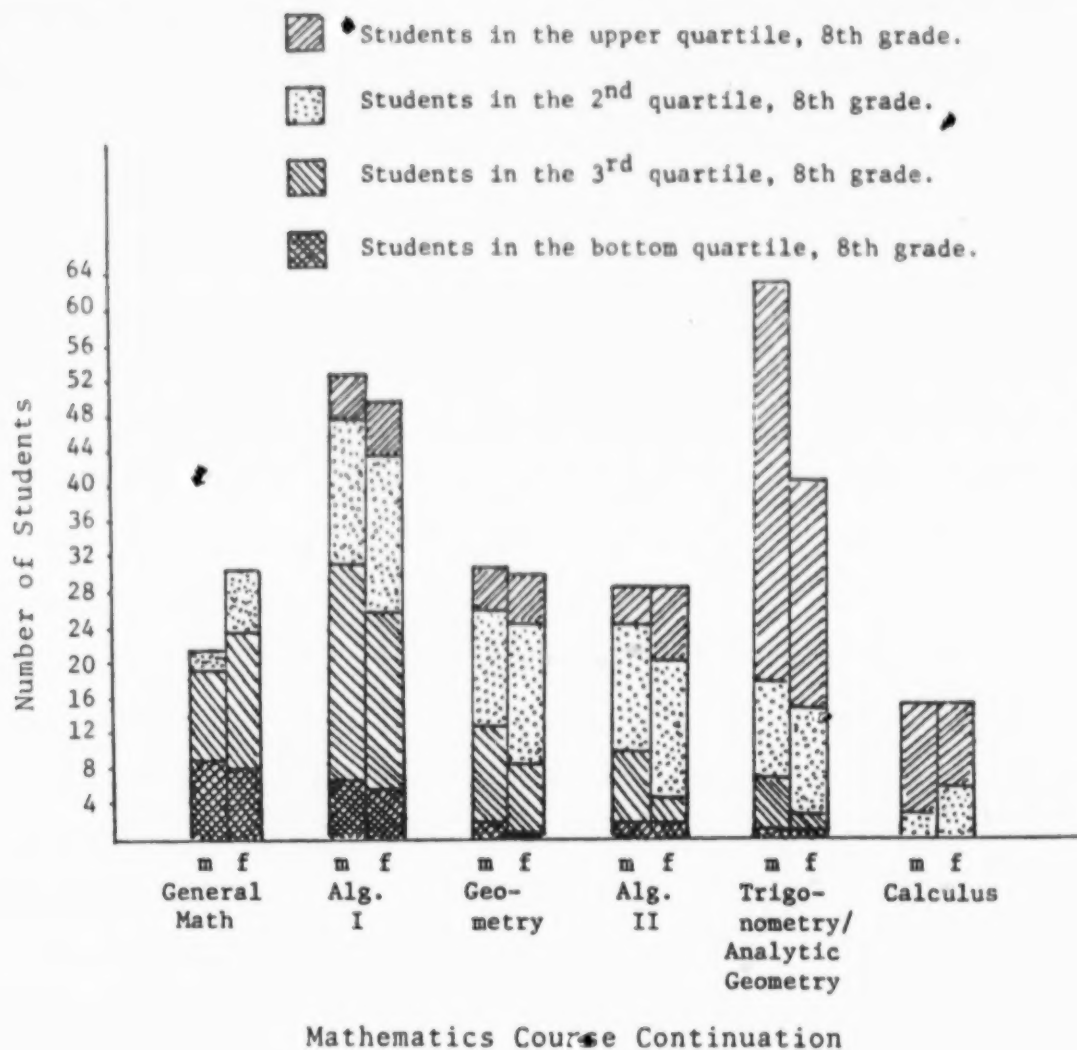
ANALYSIS AND RESULTS

Q1. What is the frequency distribution by sex and by eighth grade mathematics achievement score of student continuation in the mathematics study sequence?

Figure 1 contains the frequency distribution by sex of continuation in the mathematics study sequence. Sixty-one

Figure 1

Student Continuation in the Mathematics Study Sequence
by Sex and Eighth Grade Mathematics Achievement



percent of the students participated in mathematics courses beyond algebra I; 46% of the students participated in mathematics courses beyond geometry. Of the 208 females, 57% of them studied mathematics beyond algebra I; 42% continued beyond geometry. Of the 233 males, 64% continued in mathematics beyond algebra I; 49% continued beyond geometry.

A chi-square goodness-of-fit test was run in order to determine if the male participation across all levels differed significantly from the female participation across all levels. The result, $\chi^2(5, N = 399) = 5.73$, was not significant. Thus, there is no significant difference between the participation rate of males and the participation rate of females in the mathematics study sequence.

Figure 1 also contains the frequency distribution of eighth grade mathematics achievement score by continuation in the mathematics study sequence. A consistency, at least in achievement test performance and course participation, is noted: better eighth grade students appear to take more years of college preparatory mathematics.

Q2. What is the relationship between attitudes toward mathematics, measured at grade eight and at grade twelve, and continuation in the mathematics study sequence?

Pearson product moment correlation coefficients were computed between continuation in the mathematics study

sequence and each of the student attitude variables as measured at grade eight and at grade twelve. The correlation coefficients were computed separately for high-achieving and low-achieving males and females (see Table 1). Several statistics are interesting.

At grade eight, none of the attitude variables is significantly related to continuation in the mathematics study sequence for high-achieving females; however, for the high-achieving males, the correlation coefficient between continuation in the mathematics study sequence and each of confidence in learning mathematics, usefulness of mathematics, effectance motivation, teacher, mother, and father was significantly different from zero. In other words, certain attitudes toward mathematics appear to be more closely related to continuation in the mathematics study sequence for high-achieving males than for high-achieving females. For both average-achieving males and average-achieving females, the correlation coefficient between confidence in learning mathematics and continuation in the mathematics study sequence is significantly different from zero. For average-achieving males, usefulness of mathematics was also related to continuation in the mathematics study sequence. For average-achieving females, the positive perceptions of the father toward his daughter as a learner of mathematics and toward mathematics as a male domain were related to continuation in the mathematics study sequence.

Table 1

Correlation Coefficients Between Continuation in the
Mathematics Study Sequence and Attitudes Toward Mathematics

Attitudes	High-Achievers		Average-Achievers	
	male	female	male	female
Grade 8				
Confidence	.39**	.15	.25*	.26*
Teacher	.31**	.20	.18	.02
Usefulness	.35**	.20	.26*	.19
Mother	.30*	.17	.19	.23
Attitude Toward Success	.16	.11	.06	.15
Effectance Motivation	.33*	.13	.09	.05
Father	.31*	.18	.18	.37**
Math as a Male Domain	.17	.23	.14	.29*
Grade 12				
Confidence	.43**	.38**	.32*	.31*
Teacher	.48**	.52**	.41**	.28*
Usefulness	.47**	.48**	.38**	.43**
Mother	.40**	.46**	.30*	.35**
Attitude Toward Success	.45**	.45**	.20	.37**
Effectance Motivation	.53**	.47**	.34**	.20
Father	.48**	.46**	.27*	.55**
Math as a Male Domain	.29*	.40**	.19	.26*

* $p < .01$

** $p < .001$

At grade twelve, the correlation coefficients between continuation in the mathematics study sequence and almost all attitude variables were significantly different from zero. The only exceptions were attitude toward success and math as a male domain for average-achieving males and effectance motivation for average-achieving females. Thus, it would appear that favorable attitudes toward mathematics reflect, and are reflected by, the degree of continuation in the mathematics study sequence.

Q3. What is the relationship between student career interests, measured at grade eight and at grade twelve, and continuation in the mathematics study sequence?

None of the correlation coefficients between student career interests measured in grade 8 and continuation in the mathematics study sequence were significantly different from zero (see Table 2). Perhaps these results are reflecting a lack of focus of career interests at that age.

In grade 12, however, for high- and average-achieving males and for high-achieving females, the correlation coefficient between a career interest in a field related to science and continuation in the mathematics study sequence is significantly different from zero (see Table 2). It is difficult to determine at this point whether a strong background in high school mathematics resulted in an interest in science-related careers or vice versa. For average-achieving females, a significant correlation

Table 2

Correlation Coefficients Between Career Interest and
Continuation in the Mathematics Study Sequence

Career Interests	High-achievers		Average-achievers	
	male	female	male	female
Grade 8				
Science	.22	.02	.03	.12
Arts	.02	-.13	-.01	.11
Services	.08	-.14	.11	-.03
Management	.05	-.21	.15	-.11
Business Operations	.20	.08	.20	-.03
Technology	-.06	.02	.06	-.17
Grade 12				
Science	.32*	.38**	.26*	.21
Arts	.07	.05	.19	.08
Services	.04	.16	.16	.27*
Management	.06	.01	.10	.21
Business Operations	.10	.17	.20	.20
Technology	-.22	.02	-.02	.01

* $p < .01$

** $p < .0001$

coefficient was found between service related careers and continuation in the mathematics study sequence.

Q4. To what extent can the cognitive and affective mathematics related variables measured at grade eight serve as predictors of continuation in the mathematics study sequence?

Stepwise regression was used to identify those variables measured in grade 8 which could serve as predictors of a student's continuation in the mathematics study sequence. Four models were developed: Model 1 for high-achieving males, Model 2 for average-achieving males, Model 3 for high-achieving females, and Model 4 for average-achieving females (see Table 3). The analysis indicated that confidence in learning mathematics, teacher, attitude toward success in mathematics and the mother's perception of her child as a learner of mathematics were better predictors of mathematics participation for high-achieving males while career interests in art, management, and technology along with attitudes toward mathematics including usefulness of mathematics and math as a male domain appeared to be better predictors of mathematics participation for high-achieving females. The influence of parental attitudes on mathematics course participation became especially apparent in the model for the average-achieving females. Predictors of continuation in the mathematics study sequence for average achieving females included the daughter's positive account

Table 3

Regression Models for Continuation in the Mathematics Study Sequence

Step	Variable	R ²	F-ratio
Model 1 (High Achieving Males)			
1	Confidence in learning mathematics	.16	16.50**
2	Mother's response	.23	12.67**
3	Teacher	.25	9.64**
4	Attitude toward success in mathematics	.30	8.88**
Model 2 (Average Achieving Males)			
1	Usefulness of mathematics	.07	6.69
2	Arts	.10	5.20*
3	Business Operations	.13	4.54*
4	Father's response	.15	4.00*
5	Father's response to math as a male domain	.18	4.01*

(Table 3 is continued on next page)

Table 3 (continued)

Model 3 (High Achieving Females)			
1	Math as a male domain	.07	6.23
2	Arts	.13 [*]	5.74*
3	Technology	.18	5.65*
4	Management	.23	5.72*
5	Usefulness of mathematics	.27	5.48*
Model 4 (Average Achieving Females)			
1	Father	.12	11.69*
2	Technology	.17	8.46*
3	Mother's response	.22	7.78*
4	Father's response	.25	6.55**

* $p < .01$ ** $p < .0001$

of her father's attitude toward her as a learner of mathematics and a positive attitude reported by both parents toward their daughter as a learner of mathematics. The model for average-achieving males found usefulness of mathematics, career interests in art and business operations along with the father's positive attitudes toward his son as a learner of mathematics to better predict continuation in the mathematics study sequence. The results of this analysis suggested that males and females were continuing in the mathematics study sequence for different reasons. For example, high-achieving males appeared to be motivated by internal factors related to their perception and other people's perceptions of their ability to learn mathematics whereas high-achieving females appeared to be motivated more by an external factor; i.e., their belief that mathematics is useful to their career plans.

Q5. What is the effect of parent attitudes toward mathematics on continuation in the mathematics study sequence?

Parental influence on mathematics course participation was assessed using a statistical technique called path analysis. Path analysis is a method for studying hypothesized causal relationships among variables. For this study, it was hypothesized that participation in optional mathematics courses is influenced by parental attitudes along with student attitudes toward mathematics and student

career interests. Paths leading to mathematics course participation were found by employing a stepwise discriminant analysis on the study variables. Path coefficients were calculated for each of high-achieving males, average-achieving males, high-achieving females and average-achieving females.

The paths in Figures 2 and 3 indicate a series of causal factors leading to student continuation in the mathematics study sequence. Results of the path analysis indicate that parental and attitudinal factors associated with mathematics course participation vary by sex and by mathematics achievement. For example, the paths for high-achieving males indicated that the mother's positive perception of her son as a learner of mathematics contributed, above all other parental or attitudinal variables, to the child's decision to participate in mathematics courses. It was also found for high-achieving males that the mother's attitude toward her son as a learner of mathematics positively affected his confidence in learning mathematics which in turn contributed to his continuation in the mathematics study sequence. For high-achieving females, a common attitude between the mother and daughter that mathematics is not a male domain led to continuation in the mathematics study sequence. If the mother perceived mathematics to be a male domain, the daughter's interest in technological careers and lack of

Figure 2

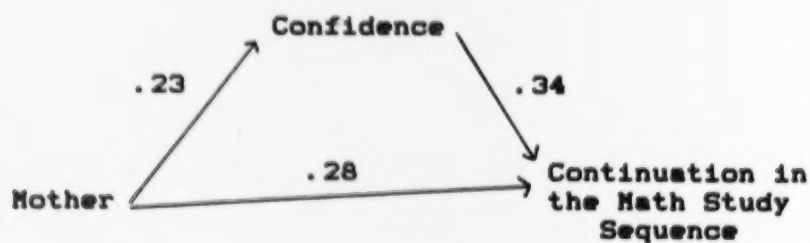
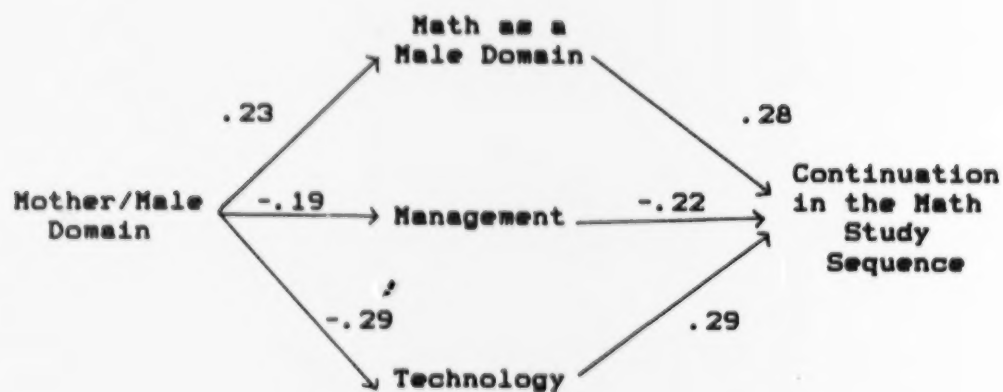
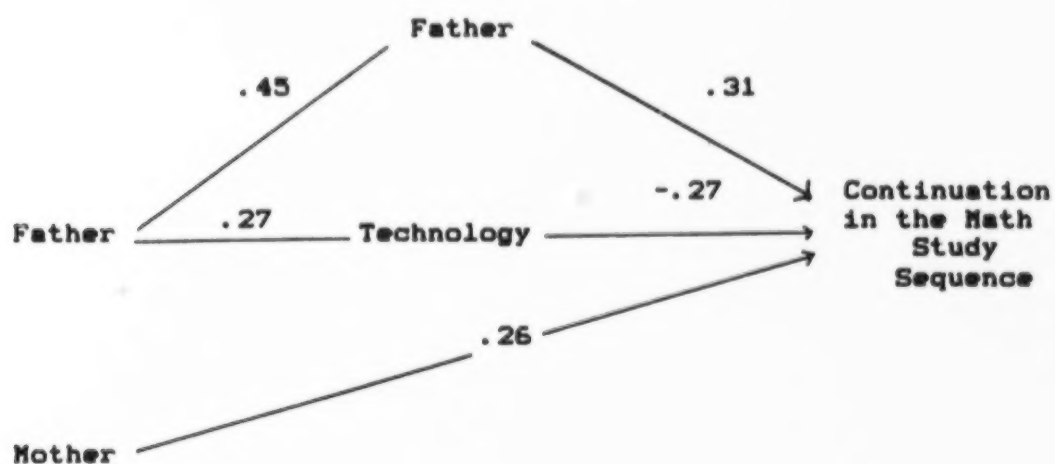
Path Diagrams for High-Achieving Males and FemalesModel for High-Achieving Males:Model for High-Achieving Females:

Figure 3

Path Diagrams for Average-Achieving Males and FemalesModel for Average-Achieving Males:Model for Average-Achieving Females:

interest in managerial careers led to continuation in the mathematics study sequence.

In contrast to the model for high-achieving males, the model for average-achieving males (see Figure 3) indicated that the student's perception of the usefulness of mathematics led to continuation in the mathematics study sequence. It also appears that the father variables are more significant than the mother's attitudes for average-achieving males. Specifically, the father's perception of his son as a learner of mathematics and the father's belief that mathematics is a male domain contributed to his son's feeling that mathematics is useful. In the model for average-achieving females, the parents have a shared influence on their daughter's decision to participate in optional mathematics courses. It appears that the daughter's lack of interest in technological careers also leads to continuation in the mathematics study sequence.

Q6. What are the changes in student attitudes toward mathematics from grade eight to grade twelve?

A comparison between student attitudes toward mathematics measured in grade 8 and measured again in grade 12 was made to detect any significant changes in attitudes. A t-test was employed to make the comparisons. Results of a t-test on mean scores indicate that attitudes toward mathematics were significantly more negative ($p < .0001$) in grade 12 on all attitude variables except mathematics as a

Table 4

Results of the t Test for Comparing Mathematics Attitudes in Grades Eight and Twelve

Attitudes	Grade 8		Grade 12		t
	$\bar{X}$	s.d.	$\bar{X}$	s.d.	
Confidence	3.73	.73	3.34	.94	-9.91*
Teacher	3.50	.57	3.25	.58	-9.05*
Usefulness	3.91	.67	3.65	.73	-6.92*
Mother	3.95	.60	3.60	.67	-11.40*
Attitude Toward Success	4.07	.60	3.84	.67	-6.80*
Effectance Motivation	3.31	.72	2.99	.82	-8.53*
Father	3.91	.76	3.60	.74	-9.88*
Math as a Male Domain	4.09	.69	4.05	.70	-1.18

* $p < .0001$

male domain (Table 4). Several conjectures could be made to explain these results. Student experiences in mathematics during high school may be more negative than those prior to the eighth grade. A second explanation for the more negative attitudes toward mathematics may be that some students have a more negative attitude toward school in general at this time.

Q7. What career interests are displayed at grade eight? What are academic plans at grade twelve?

Student career interests at grade 8 were explored using the World-of-Work map. The student's region of occupational preferences on the World-of-Work map was identified by using the People-Things and Data-Ideas subscales from UNIACT. An occupational region was determined for each student. This information was summarized by sex and by mathematics achievement in Figures 4 and 5. The maps indicate the percent of students expressing an interest in each occupations region. For example, 6.1% of the higher achieving females reported an interest in careers related to the natural sciences and mathematics, i.e., Region 8. When comparing career interests of high-achieving males and high-achieving females, 18% of the females and 13% of the males showed a preference for occupations that involved working with ideas. Nearly half of the high-achieving males and over half of the average-achieving males showed a preference for careers that involved working with things, whereas the career interests of high- and average-achieving females were

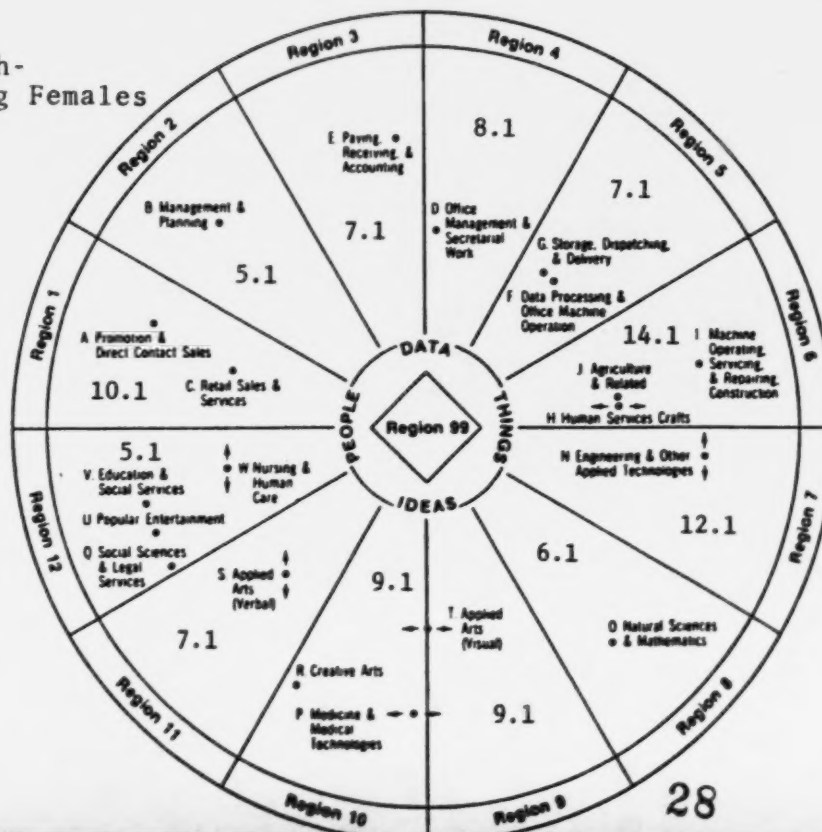
Figure 4

World-of-Work Maps for High-Achieving Males and Females

Map for High-Achieving Males

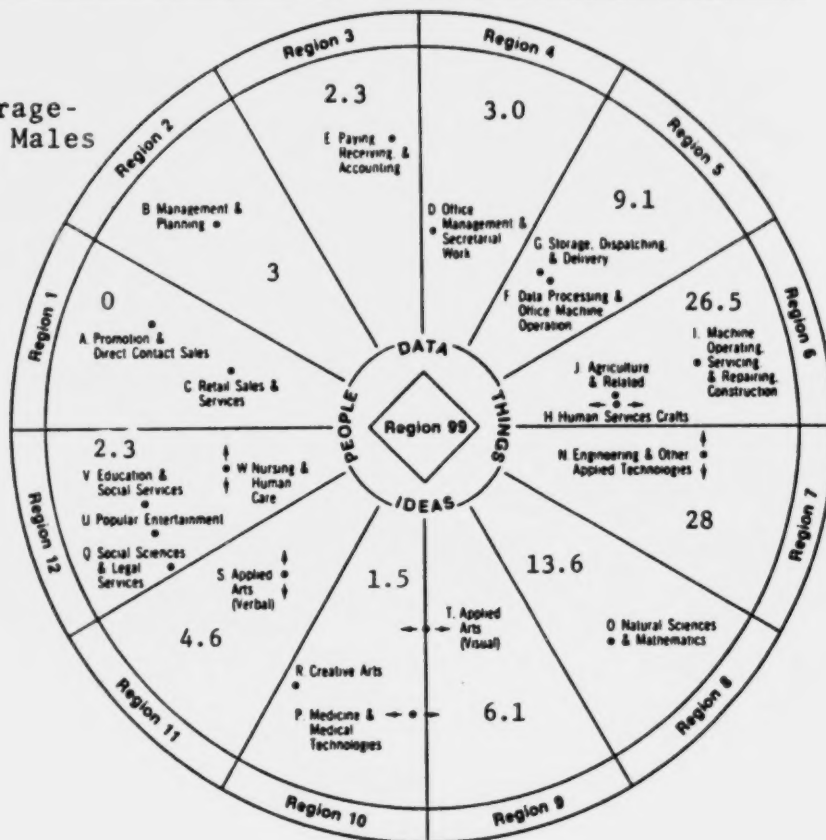


Map for High-Achieving Females

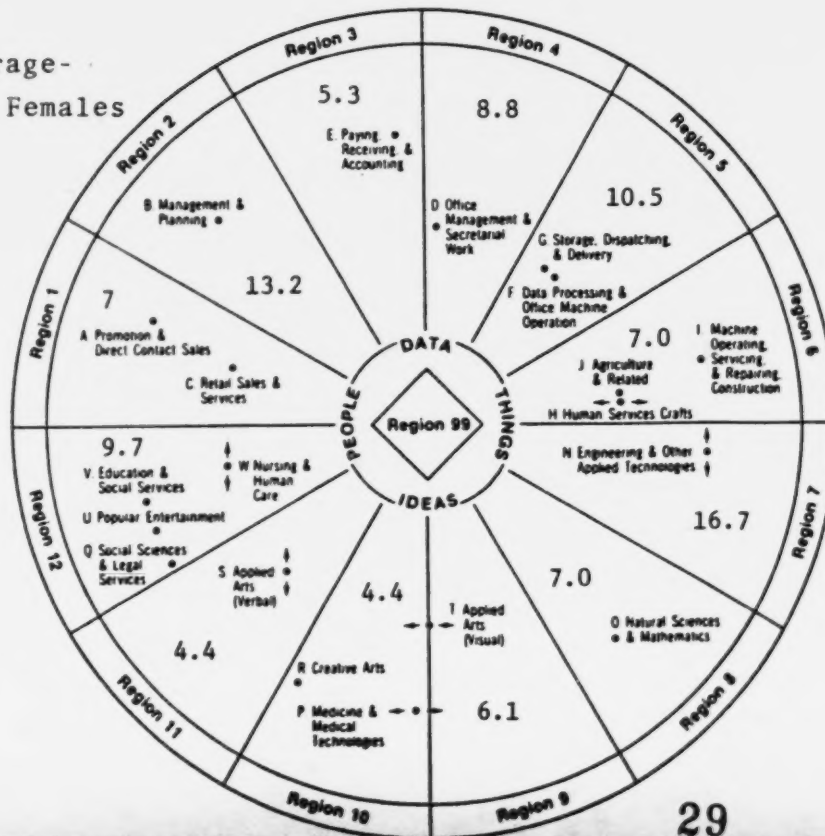


World-of-Work Maps for Average-Achieving Males and Females

Map for Average-Achieving Males



Map for Average-Achieving Females



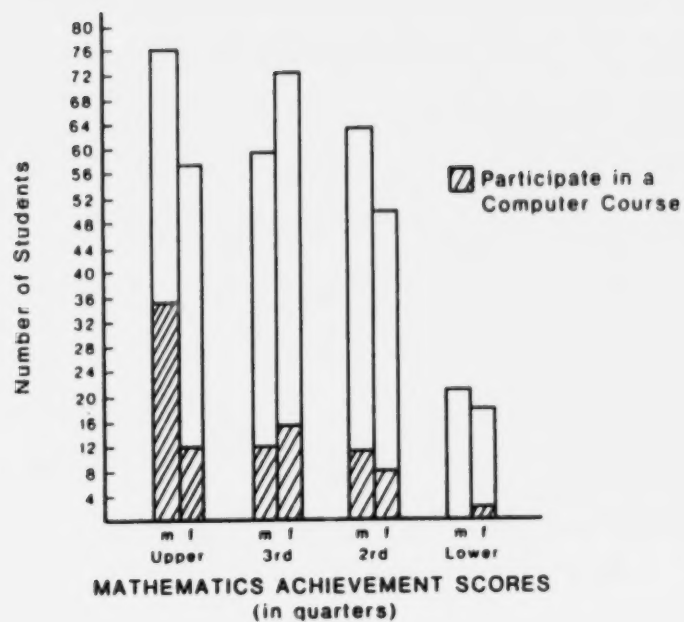
more evenly distributed throughout the People-Things and Data-Ideas dimensions. The World-of-Work Maps revealed a few interesting patterns in career interests of eighth grade students. It would appear that career interests were more a function of the student's sex than mathematics achievement. In other words, similarities in career interests were found in the maps for high- and average-achieving males (females), whereas, few similarities were found in the maps for males and females.

When students in this study were asked about their academic plans, 88% of the students responded that they planned to continue their education after graduation from high school. A majority of these students, 54%, planned to attend a university and 29% of the students planned to continue their studies at a community college. It would appear, however, that only slightly more than half of the students who planned to continue their education after high school elected to participate in the mathematics study sequence beyond geometry. Because of the demand for mathematics skills in most careers, a better understanding of why students are or are not electing to pursue a college preparatory mathematics curriculum in high school is especially relevant.

Q8. What is the relationship between affective and cognitive mathematics related variables and election of a computer course in high school?

A total of 95 students, 23% of the subjects, 58 male and 37 female, participated in a computer course during high school. The participation rate of males did not differ significantly from the participation rate of females. Figure 6 shows the relationship between computer course participation and 8th grade mathematics achievement. For each level of mathematics achievement, the proportion of males participating in a computer course did not differ significantly from the proportion of females participating in computer course. A significant difference was found between the observed participation of males in computer courses and the expected participation of males based on the proportion of males in each quarter of the mathematics achievement distribution. We conclude that mathematics achievement does influence the computer course participation rate of males. A calculation of percentages shows that approximately 60% of the males who do participate in a computer course come from the upper quarter, a quarter which represents only 35% of the male sample. The observed frequency of female participation in a computer course did not differ significantly from the expected frequency based on the proportion of females in each quarter of the mathematics achievement distribution. Thus, we conclude that female participation can be described as a random election of a computer course with equivalent representation from each level of mathematics achievement.

Figure 6
Student Participation in a Computer
Course by Sex and Mathematics Achievement



The correlation coefficients between participation in a computer course and each of confidence in learning mathematics, teacher, usefulness of mathematics and mother were found to be significantly different from zero for the total sample (see Table 5). For males, the correlation coefficients between computer course participation and each of confidence in learning mathematics and teacher were significantly different from zero. No such significant correlations were found for females.

The gender-differences in computer course participation were also seen in the regression models constructed (see Table 6). Mathematics achievement was the single best predictor of computer course participation for both males and females. For females, usefulness of mathematics, together with father's response to math as a male domain and attitude toward success in mathematics, explained an additional 5% of the variance of computer course participation. The attitude of the teacher contributed significantly to the regression model for males, over and above mathematics achievement, and reflects a positive contribution of teachers to the computer course participation of males that is not found in the model for females.

Even though the proportion of the variance of participation in computer courses accounted for by the father's response to math as a male domain was only 1% in

Table 5

Correlation Coefficients Between Participation in a Computer Course and Attitudes Toward Mathematics Measured in Grade 8

Attitudes	All Subjects	Males	Females
Confidence	.21**	.26**	.13
Teacher	.18**	.24**	.09
Usefulness	.15*	.18	.12
Mother	.17*	.23	.07
Attitude Toward Success	.07	.17	-.05
Effectance Motivation	.12	.20	.04
Father	.09	.15	.01
Math as a Male Domain	.08	.18	.03

* $p < .001$

** $p < .0001$

Table 6

Regression Models for Participation in a Computer Course

Step	Variable	R2	F-ratio
Model 1 (all students)			
1	Mathematics achievement	.11	39.56**
2	Confidence in learning mathematics	.12	22.56**
3	Business operations	.13	16.03**
4	Father's response to math as a male domain	.14	12.61**
Model 2 (Males)			
1	Mathematics achievement	.16	31.08**
2	Teacher	.18	17.49**
Model 3 (Females)			
1	Mathematics achievement	.06	9.17*
2	Usefulness of mathematics	.08	6.36*
3	Father's response to math as a male domain	.09	5.10*
4	Attitude toward success in mathematics	.11	4.45*

* p < .01

** p < .0001

each of Model 1 and Model 3, the appearance of this variable is noteworthy because of the extensive body of literature concerning the relationships between a daughter's performance in mathematics-related areas and the expectations or attitudes of the father.

The appearance of Business Operations as significant in the regression model for all students is not surprising. Occupations under the umbrella of Business Operations include computer and data processing machine operators as well as the following computer related occupations: secretary, bank teller, accountant, payroll clerk, and office machine operator. Thus, this may be evidence that students are aware of positions which require and utilize computer expertise and are acting in accord with this information by electing a computer course while in high school.

RECOMMENDATIONS

This study has explored the relationship between student attitudes toward mathematics, student career interests, and parental attitudes toward mathematics and each of continuation in the mathematics study sequence and participation in computer science courses. Efforts to increase student continuation in the mathematics study sequence should include the participation of teachers, administrators, counselors, parents and students. Parents,

teachers, and counselors play an important role in shaping student attitudes toward mathematics and should be encouraged to take a more prominent role in encouraging their students and children to elect to continue in the mathematics study sequence.

The authors hope that this study has provided some knowledge of the relationships between affective and cognitive mathematics related variables and each of continuation in the mathematics study sequence and participation in a computer course during the high school.

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